

Observation of Local Cloud and Moisture Feedbacks Over High Ocean and Desert Surface Temperatures

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Understanding the global energy and hydrology cycle depends on knowledge of how clouds and atmospheric moisture interact with the surface and the general circulation of the atmosphere. However, at this time we do not yet have the basic observational evidence required to develop theories and validate them. This paper presents new observational data on clouds and moisture and discusses their implications for climate modelling with emphasis on two specific regions: warm ocean pools in the Western Pacific and hot desert spots in Australia. The observational data show that the atmosphere reacts to local warm ocean pools in the Western Pacific Ocean with increased moisture, cloudiness and convection, leading to a negative feedback limiting the sea surface temperature rise. The reverse was observed over dry and hot deserts where both moisture and cloudiness decrease, leading to a positive feedback perpetuating desert conditions. These observations reveal complex dynamic-radiative interactions in which the horizontal surface temperature gradient plays a critical role.